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Identifying Success Factors for ECR Program: An Australian Study

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Abstract
Efficient Consumer Response is a grocery industry supply chain management initiative, designed to make the industry more efficient and responsive to consumer needs. Despite the many benefits obtainable from ECR, several studies indicate that the rate of ECR adoption has been slow. In this paper, we explore factors to which the slow uptake of ECR might be attributed, by identifying likely determinants of success with ECR implementation. Since it is difficult to find a single measure of ECR implementation success, we justify and use satisfaction with ECR as a surrogate measure to re-analysed an ECR survey of the Australian grocery industry. Based on the empirical data, a number of ECR success factors have been identified. In addition, the findings demonstrate that many Australian organisations still do not have many of the success factors in place and, hence, this study adds to understanding of the slow uptake of ECR.

***Keywords*:** Electronic commerce, Efficient Consumer Response, inter-organisational system, critical success factor, survey.

1. Introduction

Efficient Consumer Response (ECR) is a grocery industry supply chain management strategy designed to improve the competitiveness of the industry by promoting strategic initiatives in the area of store assortment, product development and introduction, promotion, and product replenishment. These four strategic initiatives are supported by two process innovations namely Category Management and Continuous Replenishment Program. These two programs are in turn supported by a number of electronic commerce enabling technologies such as barcode, electronic data interchange, computer-aided ordering, cross-docking, and activity-based costing (Kurt Salmon Associates, 1993; Clark and Lee, 1996). Although ECR originated in the United States, the concept has been influential in many western countries, as it promises significant cost savings for the grocery supply chain through the elimination of non-value-added activities (Tripplet, 1995; Leggett, 1996; Greenbaum, 1997).

Despite the many benefits obtainable from ECR, a number of studies indicate that the rate of industry-wide adoption of ECR has been slow in many regions (Kurt Salmon Associates, 1993; 1995; 995/6; 1997; Leggett, 1996; Greenbaum, 1997; Coopers and Lybrand, 1998). There are a number of technical, structural, cultural and political factors that may affect the implementation of innovations by organisations and, hence, the rate of industry-wide adoption of innovations. Many studies have been conducted to assess these factors in relation to implementation of different types of innovation (Berry, 1976; Moch and Morse, 1977; Sands, 1981; Gatignon and Robertson, 1989; Frambach, 1993). However, due to

inconsistencies in the findings they are difficult to apply directly to the specific case of ECR adoption. In this paper, we therefore explore the issue of slow uptake of ECR by identifying factors to which the adoption rate of ECR can be specifically attributed. In doing so, we particularly look at individual organisations' ECR implementation and identify likely determinants of success for ECR implementation, since successful implementation at the organisational level leads to industry-wide adoption of ECR.

However, because of the complex nature of ECR program, which consists of some technological and process innovations (Kurt Salmon Associates, 1993; Hoban, 1998), it is difficult to define a single measure of ECR implementation success. There are at least two types of criteria, each of which is multi-dimensional, that could be used to measure success in implementing any technological and process innovations:

- the *extent* of implementation, which would be measured by the number of modules in place,
- the *impact* of implementation, which would be measured by changes to key performance indicators.

The multi-dimensional nature of implementation success presents problems for the analysis of a survey of success factors, and it would be desirable to replace it with a single-variable surrogate measure of success. For this purpose, an ECR survey (Kurnia et al., 1999) of the Australian grocery industry conducted in 1998 was re-analysed. In the first part of this paper, we show that a variable named 'Satisfaction with ECR' has the expected relationship with the number of ECR components implemented under the banner of ECR and with improvements in a number of key performance indicators. Thus, the level of satisfaction of companies with ECR appears to be a reasonable single-variable candidate for such a surrogate measure of success and, hence, is used in this study to identify likely determinants of successful ECR implementation. In the original survey design, a number of factors affecting implementation of innovations were identified from an extensive literature review as summarised in Table 1 and questions were designed to assess the presence of these factors. Thus the results of the survey study can now be re-analysed to test associations between satisfaction (and implicitly, implementation success) with many of these factors.

In general, the results indicate that although retailers are leading the ECR implementation in Australia, as discovered in our previous study (Kurnia et al., 1999), the satisfaction of a company with the ECR program does not depend on the position of a company along the supply chain and the company size. A number of intrinsic factors were identified from this study, which play an important role in determining the satisfaction of companies in Australia with ECR. Despite the limitations of the 'factor-oriented' approach in understanding complex issue of adoption of inter-organisational innovation (Markus and Robey, 1988; Dawson, 1994) such as ECR, we believe this approach is the most appropriate to analyse survey results and to identify a number of likely generalisable ECR success factors. This study also contributes to an understanding of the slow uptake of ECR as it demonstrates that the Australian grocery industry has not had many of these success factors in place. Because of the uniqueness of the Australian grocery industry, with different market structure and environment, this study will also enrich the study of diffusion of ECR and inter-organisational systems in general, which is currently still limited. This study, thus, will be valuable to both practitioners and academics in the related area.
In the next section, a brief description of the survey research method employed in this study is presented. Next we justify the use of the 'Satisfaction with ECR' variable as a surrogate

measure of success. Then the survey findings are comprehensively analysed to discover associations between the factors listed above and this surrogate measure of success. Finally, we conclude the paper by summarising the key issues from the findings and outlining some related future research.

Table 1. A Summary of Factors Influencing Adoption of Innovation

Category	Factors	References
Organisational Member	Education	Gatignon and Robertson (1985); Kimberly (1981); Kwon and Zmud (1987); Coopers and Zmud (1990).
	Resistance to Change	Sands (1981); Manross and Rice (1986); Gatignon and Robertson (1989); Coopers and Zmud (1990).
	Cosmopolitanism	Kimberly (1981); Robertson and Gatignon (1986); Kwon and Zmud (1987).
Organisational Structure	Size	Baldridge and Burnham (1975); Moch and Morse (1977); Kimberly (1981); Manross and Rice (1986); Frambach (1993); Pennings (1987).
	Professionalism	Baldridge and Burnham (1975); Moch and Morse (1977); Kimberly (1981) and Kwon and Zmud (1987); Coopers and Zmud (1990); Frambach (1993).
	Formalisation	Kwon and Zmud (1987); Frambach (1993).
	ECR Centralisation	Zaltman et al. (1973); Moch and Morse (1977); Kimberly (1981); Kwon and Zmud (1987); Coopers and Zmud (1990); Frambach (1993).
	Heterogeneity	Robertson and Gatignon (1986); Kwon and Zmud (1987); Coopers and Zmud (1990); Frambach (1993).
Industrial Structure	Communication Openness	Zand and Sorensen (1975); Robertson and Gatignon (1986); Pickering (1992).
	Competitiveness	
	Industry Concentration	Kimberly (1981); Robertson and Gatignon (1986); Kwon and Zmud (1987); Grindley (1993).
Innovation	Relative Advantage	Berry (1976); Rogers (1983); Frambach (1993).
	Compatibility	Berry (1976); Rogers (1983); Frambach (1993).
	Trialability	Berry (1976); Rogers (1983); Frambach (1993).
	Observability	Zand and Sorensen (1975); Berry (1976); Rogers (1983); Frambach (1993).
	Complexity	Berry (1976); Rogers (1983); Coopers and Zmud (1990); Frambach (1993).
	Switching Costs	Berry (1976); Sands (1981); Gatignon and Robertson (1985).
	Perceived Risks	Fidler and Johnson 1984.
Information	Quantity	Frambach (1993).
	Quality	Frambach (1993).
	Value	Frambach (1993).
Management	Involvement	Zand and Sorensen (1975); White (1980).
	Support	Leonard-Barton and Deschamps (1988); Coopers and Zmud (1990); Frambach (1993); Thamhain and Kamm (1993).
	Urging	Leonard-Barton and Deschamps (1988); Thamhain and Kamm (1993).
Existing Tasks	Uncertainty	Robertson and Gatignon (1986); Kwon and Zmud (1987); Coopers and Zmud (1990).
	Responsibility	Kwon and Zmud (1987); Coopers and Zmud (1990).
	Autonomy	Kwon and Zmud (1987); Coopers and Zmud (1990).
	Variety	Kwon and Zmud (1987); Coopers and Zmud (1990).

2. The Survey Research Method

The original mail survey study was performed because it allowed us to reach a wide range of

organisations within the Australian grocery industry. Managers or any individual with specific knowledge on ECR-type implementations were requested to answer the questionnaire. The mailing list of the target population of 1000 organisations was obtained from the Grocery Industry Marketing Guide 1998, ignoring all duplicates (Retail World, 1998). As suggested by Salant and Dillman (1994), one of the approaches taken in our study in order to maximise the response rate was to survey the entire target population in order to identify those companies interested in participating in our study. Of the 1000 companies in the mailing list, only 52 companies indicated their willingness to participate in the survey. The probable reason for low interest in participating in this study is that few firms within the Australian grocery industry are involved and interested in ECR. Thus, these 52 companies formed the survey sample in this study.

Before sending out the questionnaire to the survey sample population, pilot tests were conducted with a logistics researcher and a practitioner who resembled the actual respondents to whom the questionnaire would be sent. Most of the questionnaire items were derived from the existing survey of the Kurt Salmon Associates, since it is desirable to re-use existing, well-developed questionnaires which have been tested for their reliability and validity (Lucas, 1991). For this reason, reliability and validity of the survey instrument were not explicitly examined. These two issues were, however, implicitly addressed by asking related questions in different ways and presenting the questions in the simplest possible way to avoid differing interpretations by the respondents (Fink, 1995). From the pilot tests, the validity and reliability of the questionnaire were further enhanced. The final version of the questionnaire was then sent out to those 52 participants. After two follow-ups were made via mail and phone, the number of returned questionnaire was 42 (a response rate of 81%).

Despite the small sample size, the survey participants are quite representative of the population for each organisation type due to the market share dominated. For example, although the number of participants representing the 'Retailer / Wholesaler / Distributor' group is only 11, these organisations dominated more than 30% of the total market share of the Australian grocery industry. Similarly, around 40% of the participants representing the 'Manufacturer / Broker' group dominate more than 50% of the market share of a number of products categories within the Australian grocery industry (Food Week and Liquor Week, 1998; Retail World, 1999). In addition, there are very few Australian manufacturers and retailers that are involved in ECR at this stage (Coopers and Lybrand, 1998) and we assume that the majority of those companies that were not willing to participate in this study are not involved in ECR. Thus, the small sample involved in this study actually represent a significant proportion of the entire population of those companies that are involved in ECR.

For the present study, we defined sub-groups of the sample of 42 participants according to their satisfaction with ECR. Not all responses from these 42 participants can be used in this study, since there are 17 participants who are not involved in ECR at all. These 17 participants have no experience with the ECR program and its implementation. As a result, they are not able to answer ECR implementation-related questions that constitute major part of the questionnaire and their satisfaction level with ECR cannot be identified. Only two participants not involved in ECR have significant market share. From these 17 participants, reasons for not being involved in ECR were identified, but are not particularly relevant for this study. This gives us a total of 25 responses that can be included in this present study.

The 25 respondents were asked to rate their satisfaction level with ECR based on the following five-point scale: 1 = greatly below expectation; 2 = somewhat below expectation; 3

= met our expectation; 4 = somewhat exceeded expectation; and 5 = greatly exceeded expectation. In order to improve the statistical significance of the results, we aggregated this 'Satisfaction with ECR' variable to a two-point scale: 'Not Satisfied' and 'Satisfied'. Those who selected 1 or 2 from the above scale are categorised as 'Not Satisfied', while those who chose 3, 4 or 5, are categorised as 'Satisfied'. We established that this 'Satisfaction with ECR' variable was correlated to various measures of ECR implementation success in the expected way and, thus, could be used as a surrogate measure of success. We then examined the differences in responses between the two groups in terms of ECR driving forces, perceptions, attitudes, implementation problems, negative consequences, and their explicit appraisal of all factors shown in Table 1 in relation to ECR adoption, in order to identify likely determinants of success with ECR program.

Simple statistical analysis methods such as frequency of responses for each group and rank order were used for nominal data. In some cases, Likert-scale responses were converted to numerical values using a linear scale from 1 to 5. While differences between the two groups were observed using means, which were found to be sensitive to small differences, the Mann-Whitney test for the difference of medians, based on the rank of responses, was used for significance testing of ordinal data (Coakes and Steed, 1997). To find the relationships between binary, nominal variables, the Fisher's Exact test was used because of the small sample size (Argyrous, 1996). For ordinal data, we used the Gamma test to obtain quantitative measures of the association. This test is appropriate, since the ordinal scales used in this study do not have too many categories, and can thus be displayed in a cross-tabulation (Norusis, 1983).

The Fisher's exact tests were carried out to examine if ECR satisfaction depended on type and size of company, both of which variables were aggregated to a two-point scale. The former variable consists of 'Manufacturer / Broker' and 'Retailer / Wholesaler / Distributor', while the latter consists of 'SME' and 'Large Companies'. Interestingly, the results of the tests indicate that satisfaction with ECR is independent of these external factors, type and size. In this study we therefore identified those intrinsic properties that affect the success of ECR implementation.

In this paper, the following notations are used to indicate the level of statistical significance discovered with each test:

- ^{m} Difference between the two groups is significant at 5% level, using the Mann-Whitney test.
- ^{mm} Difference between the two groups is significant at 1% level, using the Mann-Whitney test.
- ^{g} Strongly correlated with ECR satisfaction at 5% level, using the Gamma test.
- ^{gg} Strongly correlated with ECR satisfaction at 1% level, using the Gamma test.

3. Satisfaction as a Surrogate Measure of Success

In this section, we justify the use of 'Satisfaction with ECR' as a surrogate measure of success with the program, by examining the relationship between this variable with implementation level of ECR elements (the *extent* of implementation) and improvements in performance measures (the *impact* of implementation). Each of these relationships is discussed in the following sub-sections.

3.1. Satisfaction Level with ECR and the Extent of ECR Implementation

To measure the extent of ECR implementation level, participants were requested to describe their current implementation status with the ECR components from a range of responses: 'No plan to implement', 'Keen to explore further', 'Plan to begin in 12 Months', 'In testing/pilot stage', and 'Fully operational'. For each component, they were also asked to indicate if they were pursuing the component as part of ECR. Table 2 summarises the means of the responses for each of the ECR components.

Table 2. The Implementation Level of ECR Components

ECR Components	Implementation Level		Gamma
	Not Satisfied	Satisfied	
CM (n_1=10; n_2=14)	3.30	1.29 *	0.33
CRP (n_1=10; n_2=12)	2.50	3.58	0.52 *g*
Barcode (n_1=10; n_2=13)	3.90	4.77	0.70 *g*
EDI (n_1=9; n_2=13)	3.67 *m*	4.46 *m*	0.65 *gg*
CAO (n_1=10; n_2=13)	3.10	3.92	0.42
Cross-Docking (n_1=9; n_2=14)	2.67 *mm*	4.21 *mm*	0.70 *gg*
ABC (n_1=9; n_2=14)	3.67	3.43	-0.13

Scale:
1=No plan to implement, 2=Keen to explore further, 3=Plan to begin in 12 months, 4=In testing/pilot stage, 5=Fully operational.
n_1= the size of the 'Not Satisfied' group
n_2= the size of the 'Satisfied' group
* Standard deviation is large (5.64)

The results suggest that, in general, companies who are satisfied are more advanced in the implementation of ECR elements, and some of these differences are significant. In addition, higher proportions of companies in the 'Satisfied' group implemented ECR components as part of the holistic ECR program, except for cross-docking. Moderate to strong, positive relationships were discovered between satisfaction with ECR and implementation level of most of the ECR components (the gamma values are between 0.33 - 0.70), except for the activity based costing (gamma value: -0.13). One possible explanation for this exception is that activity-based costing serves as a tool to understand how profits are generated from ECR and hence, it is not really part of the operational use of ECR. Most of the strong relationships identified are significant at 5% or 1% level. Satisfaction level with ECR can thus be used as a surrogate measure of the implementation *extent* aspect of success.

3.2. Satisfaction Level with ECR and the Impact of ECR Implementation

To measure the impact of ECR implementation, respondents were requested to indicate how ECR affects a number of performance measures as shown in Table 3, based on the following five-point scale: -1 = reduced by over 20%; -0.5 = reduced by up to 20%; 0 = no change; 0.5 = increase by up to 20%; and 1 = increase by over 20%. The means of the responses for each group are presented in Table 3. The results show that companies who are satisfied with ECR have actually gained more improvement in most of the performance measures than those who are not satisfied. Most of these performance measures have strong correlation with ECR satisfaction, with gamma values ranging from 0.45 to 1.00, and some of these relationships

are significant at 1% or 5% level. This finding hence reinforces the appropriateness of the 'Satisfaction with ECR' as a surrogate measure of the implementation *impact* aspect of success. However, the results interestingly show that those companies that are not satisfied have experienced more improvement in a few performance measures, particularly in labour productivity and raw material costs. This indicates that selection of right performance measure is important to ensure satisfaction with ECR.

Table 3. Changes in Performance Measures

	Not Satisfied (n=10) *	Satisfied (n=14) *	Gamma
Increase is expected			
Sales / Turnover	0.00	0.25	0.66 [g]
Profits	0.14	0.39	0.45
Gross Margin Return on Inventory Investment	0.14	0.23	0.11
Warehouse fill rate	0.25	0.21	-0.11
Labour productivity	0.38	0.04	-0.72
Dollar sales per square foot	0.17	0.31	0.54
Profit margin	0.07	0.19	0.22
Customer satisfaction	0.29	0.50	0.82 [g]
Market share	0.00 [m]	0.29 [m]	0.83 [gg]
Decrease is expected			
Out-of-stocks	-0.13	-0.13	-0.29
Finished goods inventory	-0.29	-0.21	0.11
Invoice costs	0.07	-0.19	-0.63 [g]
Raw material costs	-0.25	-0.05	0.50
Packaging costs	-0.13	-0.05	0.19
Manufacturing costs	-0.10	-0.06	0.12
Purchasing costs	0.13	-0.23	-1.00 [gg]
Warehousing costs	0.00	-0.27	-0.56
Transport costs	0.00 [m]	-0.39 [m]	-0.77 [gg]
Marketing (promotion) costs	0.25	-0.07	-0.77 [g]
Administrative costs	0.17	-0.08	-0.45
Increase or decrease, depending on the business strategy			
Variety of products	0.10	-0.08	-0.40
Number of SKUs	-0.06	-0.08	0.08
Category space allocation in store	0.00	0.25	0.56

Scale:
-1=Reduced by over 20%; -0.5=Reduced by up to 20%; 0=No change; 0.5=Increased by up to 20%; 1=Increased by over 20%.
* Missing value exists for some performance measures.

4. The Survey Findings

4.1. Demographic Information

Table 4 depicts the locations of the participants and the numbers of questionnaires sent to each location, as well as the numbers of questionnaires returned from each location. The majority of participants are located in the two most densely populated States: New South Wales (NSW) and Victoria (VIC). The 42 respondents consist of 59% manufacturers, 14% brokers, 7% retailers, 10% wholesaler and 10% retailers, as shown in Table 5. Seventy percent of the respondents are SMEs, with annual sales below $100 million in the last

financial year, and 30% of the participants are large enterprises.

Table 4. Survey Distribution and Responses by State

	Distributed		Returned	
State	**Frequency**	**%**	**Frequency**	**%**
NSW	19	36	14	33
VIC	18	36	16	38
QLD	8	15	7	17
WA	6	11	4	10
SA	1	2	1	2
Total	**52**	**100**	**42**	**100**

Table 5. Survey Respondents by Company Type

Company Type	Frequency	%
Manufacturer	25	59
Broker	6	14
Retailer	3	7
Wholesaler	4	10
Distributor	4	10
Total	**42**	**100**

As discussed in the research method section, only 25 out of 42 responses can be used in this study, since there are 17 participants who are not involved in ECR. In the next sub-sections, the differences between responses from 'Satisfied' and Not Satisfied' groups are meticulously analysed in terms of ECR driving forces, perceptions, attitude, implementation problem, negative consequences and their explicit appraisal of factors influencing implementation of innovation.

4.2. ECR Driving Forces

Respondents were provided with a number of possible catalysts for ECR implementation and were requested to indicate which one(s) drove their companies to get involved in ECR. An analysis was conducted to examine if there were any differences in the catalysts that drove companies to get involved in the program between those who are satisfied with ECR and those who are not satisfied.

For both groups, pressure by trading partner appears to be the major driving force, while for some respondents from both groups, internal pressure to improve performance has also been the driver. Those who are satisfied with ECR are more concerned with the competitiveness of their companies. An association was discovered between 'Improve Competitiveness' and 'Satisfaction With ECR' variables and this association is significant at 5%. This implies that those who are satisfied also have strategic reasons (long-term goals) as well as operational reasons (short-term goals of improving performance). Arguably, the relatively high percentage (30%) of the 'Not Satisfied' group that chose 'Other' had no clear vision, since they could not specify what drove them to get involved in ECR. This finding further suggests that although the majority of companies within the Australian grocery industry were pressured by their trading partners to get involved, they can still successfully implement the program if they have a clear vision of what can be achieved from it.

4.3. Perception of ECR

The respondents were asked to describe ECR in terms of a number of characteristics depicted in Table 6 based on a five-point scale: from very low (1) to very high (5). The results indicate that the 'Satisfied' group has more favourable perception than the 'Not Satisfied' group for each ECR characteristic. A further analysis discovered moderate to strong relationship between ECR satisfaction and many of the ECR characteristics. Thus, consistent with the existing literature, characteristics of ECR perceived by its potential adopters impact the

satisfaction with ECR, which in turn affect its adoption rate.

Table 6. The Mean of the Perceived Characteristics of ECR

ECR Characteristics	Not Satisfied (n=10)	Satisfied (n=14)	Gamma
Relative	1.70 [m]	3.14 [m]	0.80 [gg]
Compatibility	2.80	3.36	0.41
Trialability	2.80	3.08	0.35
Observability	2.60	2.93	0.26
Complexity	3.78	3.07	-0.66 [g]
Switching Costs	3.10	3.07	-0.23
Perceived Risks	3.00	2.36	-0.38

Scale: 1 = Very Low; 2 = Low; 3 = Medium; 4 = High; 5 = Very High

4.4. Commitment of Management and Trading Partners

Participants were requested to describe the overall commitment of various management functions and their trading partners towards ECR, 12 months ago and today, based on a five-point scale: from very negative (-1) to very committed (1).

Table 7. Commitment Level of Management Functions and Trading Partners

	Not Satisfied		Satisfied (n=14)*		Gamma
	12 Months	Today	12 Months	Today	
Management Functions					
Senior Management	0.30	0.60 [m]	0.64	0.86 [m]	0.73 [gg]
Marketing/Merchandising	0.35	0.50	-0.57	0.68	0.51
Logistics /Distribution	0.22 [m]	0.50 [m]	0.68 [m]	0.86 [m]	0.81 [gg]
Manufacturing	0.29	0.33	0.57	0.56	-0.03
Retail Outlets	0.33	0.42	0.64	1.00	1.00 [gg]
Finance	0.31	0.44	0.27	0.70	0.53
IT Department	0.33	0.56	0.64	0.89	0.86 [gg]
Trading Partners					
Large Suppliers	0.40	0.44	0.58	0.58	0.28
Small Suppliers	-0.05	0.22	0.12	0.19	-0.07
Large Customers	0.60	0.72	0.65	0.85	0.33
Small Customers	-0.05	0.25	0.08	0.21	0.00

Scale:
-1 = Very Negative; -0.5 = Somewhat Negative; 0 = Not Committed; 0.5 = Somewhat Committed; 1 = Committed
* Missing value exists for some categories

The results of the analysis show that the management functions of companies who are satisfied with ECR show higher commitment towards ECR, 12 months ago and today. Many of these differences are statistically significant at 5% or 1% level, as indicated in the Table 7. Small trading partners for both groups, however, show low commitment towards ECR. In general, for both groups, there have been improvements in commitment level of various management functions over the last 12 months. An exception occurs for the manufacturing function, which has been rather static for both groups. Further analysis discovered strong relationships between satisfaction with ECR and the commitment of most of the management

functions (gamma values are over 0.50), except for the manufacturing functions. Some of these strong relationships are significant at 1% level. We assume that those management functions with high commitment level will provide necessary support for ECR implementation. These findings thus suggest that as in implementing other innovations, adequate commitment and support from management is required for successful ECR implementation.

4.5. Implementation Problems

Respondents were provided with a list of possible problems encountered during ECR implementation. For each implementation problem, the respondents were asked to indicate how severe the problem was for their company, based on a four-point scale. Differences and similarities in responses by the two groups were then examined.

The findings show that both groups encountered problems in getting skilled personnel, developing a plan, prioritising resources between functions, measuring performance, getting the required information systems, and information sharing. These problems are more severe for companies who are not satisfied with ECR, and some of the differences are statistically significant at 1% level. The top three implementation problems cited by the 'Not Satisfied' group are related to lack of education. This implies that education on ECR has impacts on the satisfaction with the program. In addition, companies who are not satisfied, experienced more financial problems, while companies who are satisfied were concerned with the actual execution of the program. This suggests that these companies are in the later stages of ECR implementation, and thus further supports our justification of the use of satisfaction as a surrogate measure.

Further analysis indicate a strong, negative association between ECR satisfaction with 'Shortage of personnel with necessary skill', 'Lack of clear roadmap', 'Category managers insufficiently trained', 'Reluctance of trading partner to share information', 'Shortage of investment capital', and 'Reluctance to outlay initial expenditure', with gamma values range from –0.58 to –0.91. 'Inaccurate performance measure', 'Trading partners' capabilities are inadequate', and 'Poor execution of ECR initiative' have moderate, negative association with ECR satisfaction (gamma values range from -0.30 to -0.49).

4.6. Negative Consequences

Negative consequences experienced by both groups were also examined in this study. Respondents were provided with a list of negative consequences of adopting ECR and were requested to select any of the consequences they experienced. Table 8 depicts the percentage of respondents in each group who cited the negative consequences listed.

Table 8. Negative Consequences Encountered by Respondents

Negative Consequences	Not Satisfied (n=10)	Satisfied (n=14)
Losing key personnel	10%	0%
More costs involved	60%	35%
Employee morale problem	20%	7%
Diminished customer service	10%	0%
Losing valuable trading partners	0%	0%
Lost sales due to out-of-stock	20%	14%

The results show that most of the negative consequences of adopting ECR were encountered by companies who are not satisfied. Both groups cited 'Greater costs involved', 'Employee morale problems', and 'Loss of sales due to out-of-stock' at different proportions. There is a higher proportion of the 'Not Satisfied' group who experienced these negative consequences than the 'Satisfied' group.

4.7. Factors Affecting ECR Implementation

The survey respondents were asked to give their own appraisal of the factors identified in the literature of implementation of innovations that may affect ECR implementation. All factors summarised in Table 1 were included in the questionnaire. The respondents were then requested to indicate whether each factor has a negative impact, no impact or positive impact on the adoption of ECR. The analysis indicates that cosmopolitanism (external integration or outside contacts with people in other organisations or industries) and heterogeneity (the degree of differences among organisational members, in terms of beliefs, education, social status, and the like) have no impact on ECR adoption. The results of the Gamma test show that there are eight factors that have strong relationships with ECR satisfaction, as depicted in Table 9.

Table 9. Factors with Strong Association with ECR Satisfaction

Factors	Gamma
Education	0.65 [g]
Size of Company	0.82 [gg]
Professionalism	0.66
Communication Openness	0.55
Competitiveness	0.58
Quantity of ECR Information	0.54
Management Involvement	0.55
Management Urgency	0.54

Interestingly, the survey respondents believe that size of company has a strong, positive association with ECR satisfaction and, this contradicts our statistical analysis discussed in the research method section. It thus appears that it has been a common belief (which is not necessarily true) that large companies are more likely to succeed in ECR implementation. Consistent with previous findings, education and professionalism are discovered to be important factors for ECR adoption and education is found to be positively related with ECR satisfaction at 5% level of significance. Likewise, communication openness, competitiveness, quantity of information about ECR, management involvement and urgency also have strong positive relation with ECR satisfaction.

5. Discussion and Conclusions

We have presented evidence that satisfaction with ECR can be used in place of a complex multi-dimensional notion of successful ECR implementation. We have investigated the relationship between this variable and other variables in the survey and identified a number of success factors for ECR implementation. In addition, some of these factors were also identified explicitly by the respondents. Figure 1 depicts all the success factors identified from this study, which are classified into technological, organisational or external factors.

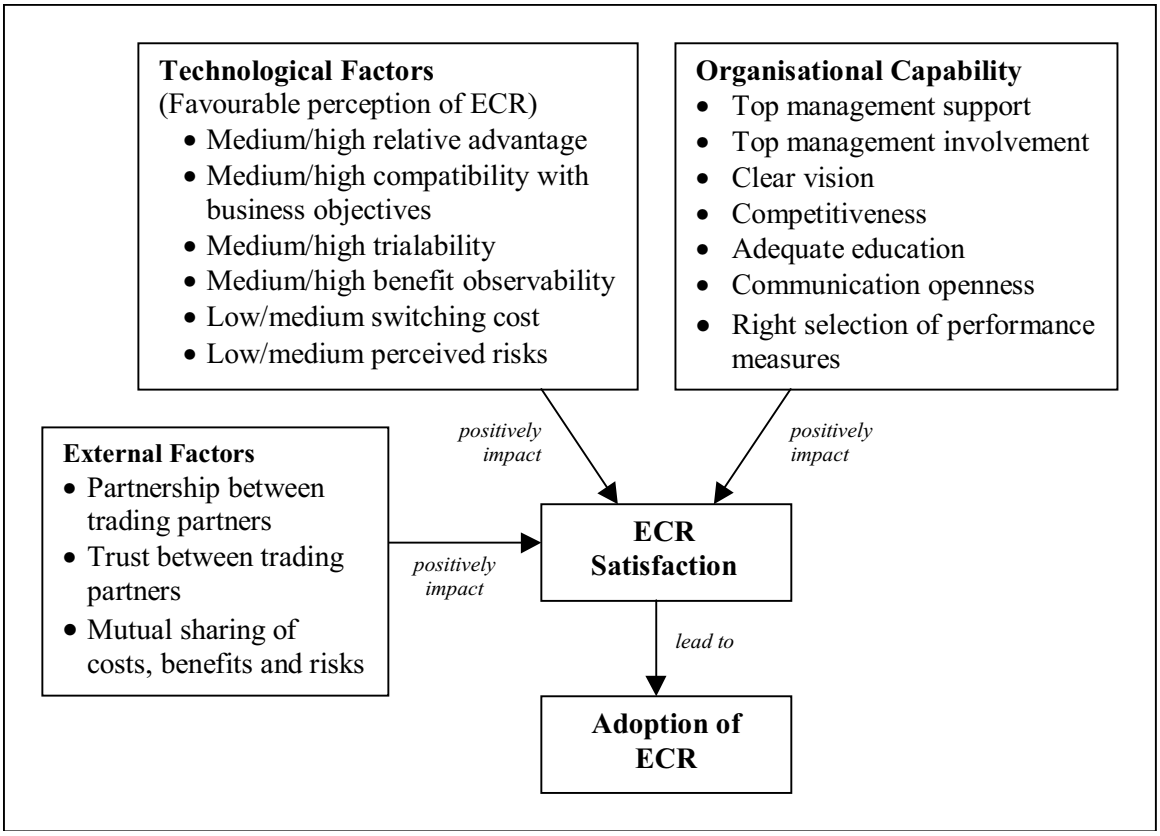

Figure 1. Summary of ECR Success Factors and Their Relations with ECR Satisfaction

The following points summarise the factors shown in Figure 1 as the contribution of this research toUnderstanding the ECR success factors:

5.1 Favourable Perception of ECR Characteristics

This study has demonstrated that having a favourable perception of ECR characteristics in terms of its relative advantage, compatibility, trialability, observability, complexity, switching costs and perceived risks leads to satisfaction with ECR. Thus, the way the potential adopters perceive ECR characteristics also impact its implementation success at the organisation level and hence, industry-wide adoption rate.

5.2 Top Management Support and Involvement

This study also shows that there is a strong relationship between commitment of various management functions and satisfaction with ECR. The respondent's own appraisals also indicate that management involvement and urgency have a strong positive relationship with ECR satisfaction. This evidence suggests that adequate support and involvement from top management is essential for the success of ECR program within a company, as has been found in other studies (Kwon and Zmud, 1987; Leonard-Barton and Deschamps, 1988; Frambach, 1993). With this support, the required resources for ECR program can be obtained easily.

5.3 Clear Vision

The results of the analysis suggest that companies need to have clear strategic and operational objectives of ECR implementation in order to be successful in the implementation. Consistently, competitiveness within the industry was found to have a strong association with ECR success. Therefore, although pressure from trading partners is the major reason for most companies within Australian industry to get involved in ECR, companies so pressured are still able to succeed in their ECR program if they have a clear vision of what is to be achieved from ECR.

5.4 Education

Education enables companies to have clear vision, get support from management, and have favourable perception of ECR characteristics, through better understanding of the program. Education is also required to ensure the correct execution of the programs improve communication openness. All this is essential to succeed in the ECR implementation. Lack of education (indicated by shortage of personnel with necessary skill, lack of a clear roadmap and insufficient training of category managers) has been a major problem to the survey respondents who are not satisfied with ECR. Consistently, education and professionalism were found to have a strong, positive association with the success of ECR program. In addition, the respondents also realised adequate information about ECR has a positive impact on ECR implementation.

5.5 Selection of Performance Measures

Those survey respondents who are not satisfied with ECR have indeed experienced some improvement in a number of performance measures. Assuming (as argued here) that satisfaction is a good indicator of ECR success, then the observation that certain performance measures have shown improvement in both the 'Satisfied' and 'Non Satisfied' groups suggests that selection of appropriate performance measures is an important part of evaluating ECR success. In addition, the survey analysis discovered a moderate, negative association of ECR satisfaction with implementation problems due to inaccurate / inappropriate performance measures. This finding is consistent with what has been reported by other authors (Scheier, 1996; Knill, 1997).

5.6 Partnership and Trust

The survey findings also indicate that reluctance in sharing information between trading partners has hindered companies from achieving success in their ECR program. Since the ECR program embraces all parties within the supply chain, companies have to move away from the traditional adversarial relationship toward collaborations with trading partners for mutual benefits. Communication openness within and between companies, therefore, has a strong, positive association with ECR success, as discovered in this study.

5.7 Mutual Sharing of Benefits, Costs and Risks

Both groups of the survey respondents indicated that they experienced more costs involved and lost sales due to out-of-stock in their ECR program. Thus, although ECR has potential to remove costs, it may introduce additional costs at the early stage because of the changes in attitude and practice the program proposes. Companies need to be aware of this fact and be

prepared to share and bear negative consequences that may incur for a short period only, for a better performance for all parties. This can only be achieved through partnership and trust between trading partners.

In our study, almost half of the respondents have not had these success factors in place, and therefore, are not satisfied with ECR. In order to accelerate the adoption rate of ECR within the Australian grocery industry, it is essential to have more companies succeed in ECR implementation and, hence, be satisfied with the program. As more companies are satisfied with ECR, it is likely that those companies with a 'wait-and-see' attitude will come onboard if they want to stay competitive. The overall findings from this study have also demonstrated that although retailers are leading manufacturers in ECR implementation in Australia (Kurnia et al., 1999), any type of company, regardless of their position in the supply chain, can indeed be satisfied with ECR implementation. In addition, this study has also shown that ECR satisfaction is independent of size of company. Therefore, the common belief, which was also expressed by the participants of this study as shown in Table 9, that only large companies can be successful in their ECR program does not hold true. This study, thus, provides incremental understanding of the slow uptake of ECR, based on the experience of the Australian grocery industry.

Despite the small sample size, these results are generalisable to a certain extent due to the large proportion of the market share dominated by the survey participants and the small number of Australian retailers and manufacturers that are involved in ECR at this stage. However, the extent to which ECR adoption can be investigated by survey method is limited by the necessary focus on individual organisations as the unit of analysis. Since ECR is an inter-organisational innovation, further studies focusing on the entire supply chain as a unit of analysis are required to obtain more in-depth understanding of the underlying issues. Such case studies will also enable us to study the interactions between trading partners within a supply chain which ultimately affect the uptake of ECR. Therefore, we are currently conducting multiple case studies within a number of Australian retailer and manufacturer pairs, in order to corroborate the findings obtained from our survey.

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